

**A Critical Review and Pilot Study:  
Mindfulness Practice, Executive Function and Narrative Retell in Kindergarten Aged Children:**

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This study reports a critical review and pilot study examining the relationship between mindful practice, executive functioning skills and narrative retell in kindergarten children. For the critical review, studies evaluated included three opinion research papers, one nonrandomized clinical trial study, and one randomized clinical trial study. The results point to a somewhat suggestive relationship between mindfulness practice and executive function skills in young children. In the pilot study, data was gathered from typically developing kindergarten children (n = 4) in a yoga storytelling and stationary storytelling setting. Results from the study showed no improvement in story retell in the yoga condition.

### ***Introduction***

#### Mindfulness and Yoga

Mindfulness and yoga have become buzz words in the realm of health, wellness and education. The interpretation of what mindfulness and yoga entail varies considerably across contexts and within variations of practice. Kabat-Zinn (1994), a prominent writer and presenter in the realm of mindfulness, states that mindfulness is, “paying attention in a particular way, on purpose, in the present moment and non-judgmentally.” Mindfulness has also been explained through participation in a variety of practices such as observing and describing moment to moment experiences, responding with awareness, compassion, refraining from judgment, relaxation, mental imagery, altered states of consciousness and non-reaction to uncomfortable experiences or thoughts (Black, Milam & Sussman, 2009; Flook et al., 2010; Mendelson et al., 2013; Nadler et al., 2017; Semple et al., 2009; Tang, Yang, Level & Harold, 2012; Zelazo & Lyons, 2012).

Yoga is a physical practice that incorporates the components of mindful awareness and promotes a mind-body connection. The practice of yoga involves exploring various movements or physical postures (asanas), breathing practice (pranayama), relaxation and meditation to promote awareness of the body in space and direct attention to the present experience (Birdee et al., 2009; Flook et al., 2010; Toscano & Clemente, 2008). Yoga is therefore a component of mindfulness. Movement activities can help children stay focused for mindful reflection (Zelazo & Lyons, 2012).

A yoga practice may be a prerequisite for a child to establish a mindful practice. He must first understand that his body exists in space; this is done through movement. As early as the first few weeks of life, infants explore their world and learn through movement. Primitive reflexes are the basic motor skills that allow an infant to gain control over the muscles in his body (Goddard

Blythe, 2005). As the child begins to explore movement patterns, proprioceptive and vestibular input feedback to orient the body (Hannaford, 2005). This leads to an understanding of where the body is in space. Children who have not integrated sensory input through exploration and movement may be less competent in theory of mind skills, that is, their ability to understand their own and others' mental states (Chasiotis, Kiessling, Winter & Hofer, 2006). As the child develops and grows, the cerebellum can modulate motor performance as well as play a role in mental imagery of movement and later, sequencing tasks (i.e., time, days of the week) that require executive functioning skills (Goddard Blythe, 2005).

#### Mindful Practice and Executive Function

Executive functioning (EF) skills include the abilities to plan, organize, and set goals through working memory, self-regulation, attention and inhibitory control. These skills are necessary for success in academics and the classroom environment (Blair & Razza, 2007; Diamond & Lee, 2011; Howse, Calkins, Anastopolous, Keane & Shelton, 2003). According to the Ontario Ministry of Education (2014), children who can understand and regulate their emotions will be better able to reach their full potential within the school setting, therefore they will need to learn the skills to self-regulate, attend to classroom material and inhibit their own desires for classroom participation and cooperation. EF skills (attention, working memory and inhibitory control), also referred to as behavioural regulation skills, contribute to kindergarten children's math, vocabulary and emergent literacy skills (Brock, Rimm-Kaufman, Nathanson & Grimm, 2009; McClelland et al., 2007; Ponitz, McClelland, Matthews & Morrison, 2009).

Mindful practices have also been shown to affect executive functioning skills (attention, shifting, inhibition, theory of mind, self-regulation) in children and adolescents (Diamond, 2012; Diamond & Lee, 2011; Flook et al., 2010; Flook, Goldberg, Pinger & Davidson, 2014; Manjunath & Teles, 2001; Nadler et al., 2017;

Razza, Bergen-Cico & Raymond, 2013; Steiner, Sidhu, Pop, Frenette & Perrin, 2012; Semple et al., 2009; Tang, Yang, Level & Harold, 2012; Zelazo & Lyons, 2012). Spatial memory scores have been noted to increase in elementary aged children following a yoga practice (Manjunath & Teles, 2004; Naveen et al., 1997). Unique to mindfulness practices is the ability to target both bottom up contributors to self-regulation (i.e., anxiety, arousal and motivation) as well as top down processes such as reflection (Zelazo & Lyons, 2012).

Interventions targeting EF skills have been shown to have the most significant effect on children with lower baseline EF skills (Diamond, 2012; Diamond & Lee, 2011; Flook et al., 2010; Flook, Goldberg, Pinger & Davidson, 2014; Razza, Bergen-Cico & Raymond, 2013). Such results speak to the need for early intervention for EF skills training to promote student success. EF skills develop rapidly in the preschool years, however, there is limited data on the application of yoga and mindfulness in the early school years (Birdee et al., 2009; Nadler et al., 2017; Zelazo & Lyons, 2012)

### ***Objectives***

The objective of this paper is to review existing literature exploring mindfulness and yoga in kindergarten children related to executive function skills. The secondary objective of this paper is to investigate participation in a small-scale study involving story retelling and yoga practice with kindergarten children. The tertiary objective of this paper is to propose clinical implications for Speech Language Pathologists (SLPs) practicing in early language development through the education system.

### **Study #1 Critical Review** ***Methods***

#### **Search Strategy**

Computerized databases including PubMed and PsychInfo as well as Western Libraries Database and Google Scholar were searched using the following search strategy: [(yoga) OR (mindfulness) AND (self reg\*)] OR (executive function) AND (children)]. Reference lists of previously searched articles were also used to obtain other relevant studies.

#### **Selection Criteria**

Studies selected for inclusion in this review included children in the early school years (preschool to kindergarten). All subjects had to be between the ages of 3-7 years. Results of these studies were selected based on discussion of potential influence on executive functioning skills (i.e., cognitive flexibility, delayed gratification, self-regulation, sustained attention). Two articles (Diamond, 2012 and Diamond & Lee, 2011)

describe activities that may improve executive functioning skills.

#### **Data Collection**

Results of the literature search yielded five articles that met the selection criteria. The articles included three Level 4 research studies that hypothesize about child behaviour related to executive function and mindful practice (Diamond, 2012; Diamond & Lee, 2011; Zelazo & Lyons, 2012), one Level 2a mixed study (Razza, Bergen-Cico & Raymond, 2013) and one Level 1 mixed study (Flook, Goldberg, Pinger & Davidson, 2015). Levels of evidence is based on Archibald (2015).

### ***Results***

**Diamond (2012)** provided a discussion paper describing executive functioning (EF) skills and reviewing the current evidence for activities that improve a child's executive functioning. Although details regarding studies chosen to be included in the paper and potential biases were not reported, Diamond is a well-recognized expert in the field. Nevertheless, the paper provides a reasonably comprehensive review of current EF theory, and training results. Diamond highlighted findings that EF training requires repeated practice, and shows limited transfer. As well, exercise as a training method was reported to be more beneficial when combined with a program that includes mindfulness (i.e., yoga or martial arts). The author hypothesizes that interventions combining EF with emotional, social, or physical activities may be more beneficial, and that children will be more likely to participate in activities that they enjoy and those that help them feel socially included.

Overall, this study provides somewhat suggestive evidence that including movement activities with mindfulness could be associated with improvements in EF skills.

**Diamond and Lee (2011)** provided a discussion paper describing program commonalities among interventions aimed at executive function (EF) development in children 4 to 12 years old. The authors describe 6 approaches for improving EFs in children, however detail regarding study inclusion criteria was not evident. Diamond is a well-known expert in the field of EF. Diamond and Lee highlighted the need for physical exercise combined with mindfulness and this may be more beneficial in promoting EF in older children. Young children may benefit most from EF activities based in school curricula. The authors suggested 11 strategies that speak to ways to support EF development based on the 6 outlined approaches.

Overall, this study provides somewhat suggestive evidence that including movement activities with

mindfulness could be associated with improvements in EF skills of older children.

**Zelazo and Lyons (2012)** provided a discussion on mindfulness training in early childhood from a developmental social cognitive neuroscience perspective. This specific perspective speaks to the potential bias of this paper. The authors describe the importance of self-regulation skills and the contribution of both top down regulatory processes (i.e., executive function skills of cognitive flexibility, inhibitory control and working memory) and bottom up influences (i.e., stress, arousal and anxiety) on self-regulation, both of which are evident in a mindfulness practice. Although details regarding study inclusion are not mentioned, Zelazo is a well-known researcher in child development and previously served as the Canada Research Chair in developmental neuroscience. The authors hypothesize the need to adapt mindfulness practices for children, the neural pathways that may be strengthened through mindfulness practice and the potential influence of mindfulness training on top down and bottom up processes.

This study provides suggestive evidence that mindfulness activities can be age appropriate and can foster self-regulation.

**Razza et al. (2013)** evaluated a mindfulness-based yoga program for self-regulation in a mixed study with 29 children (age 3 to 5 years) in two preschool classrooms at the same public elementary school in Syracuse, NY. This study utilized a pretest-posttest design with a non-equivalent group as one teacher and her classroom served as the intervention group and the other teacher and her classroom served as the control group. Pretest-posttest measures included a published parent questionnaire on self-regulation, as well as published child measures of effortful control (EC), executive function (EF), and attention. Appropriate statistical analyses were completed. The intervention group performed better across all three measures of self-regulation as compared to the control group, however findings were not generalized to parent report. Children with lower baseline EC and EF skills showed greater improvement on posttest results.

Strengths of this study included the use of a control group and the use of multiple measures for EC, EF and attention combined with parental report as measures of child behaviour. However, the authors did not consider the impact of working memory, a cognitive process arguably tapped in all of their tasks. Lack of protocol standardization may have provided ease for teachers, however makes study replication difficult. Overall, this study provides suggestive evidence that including

mindfulness-based activities in a classroom setting improves young children's self-regulation.

**Flook et al. (2015)** utilized a mixed randomized controlled design to assess executive function, self-regulation and prosocial behaviour in 68 preschool children following a 12-week mindfulness-based Kindness Curriculum (KC). Classrooms were recruited through a public-school board in a Mid-western US city and children were randomly assigned by classroom to either a KC classroom or a wait-list control group. The KC program included literature, music and movement to teach kindness and compassion. Pretest and posttest measures included published and study specific measures as well as school grades. Appropriate statistical analyses demonstrated that children in the KC classroom showed larger gains in teacher-reported social competence, higher grades and greater effect size on the measure of cognitive flexibility, but not on the measure of inhibitory control. Children with lower baseline functioning significantly benefited from the KC program.

Strengths of this study included a randomized control group with appropriate statistical treatment including variance in outcome attributed to classroom differences. Limitations included a small sample size and the lack of study blindness by the teachers as this may make teacher-rated behaviour observation biased. Effect size for grades related to social/emotional development was large however the effect size for the remaining variables ranged from medium to very small. Overall, this study is suggestive that mindfulness training can be beneficial for some academic and behavioural outcomes, generally related to emotional and social functioning.

## ***Discussion***

The results of the five studies reviewed are somewhat suggestive of the effect of mindfulness on executive functioning skills in young children. Lack of rigorous studies and lack of standardized definition of mindfulness and yoga with this young age group make definitive conclusions difficult. Variability of mindfulness practices and activities leads to difficulties with study replication and potential comparison across similar domains. Results warrant further study and gives purpose to the second half of this paper which will explore the results from a pilot study on yoga based mindfulness practice and story retell in kindergarten children.

### **Study #2: Pilot Study**

#### **Executive Function and Story Retell**

One task often employed in early literacy classrooms, to assess and promote a child's oral language comprehension and production, is the ability to retell a

story. The Kindergarten Program specifically expects children to be able to retell stories, in proper sequence (Ontario Ministry of Education, 2016). Story retells require executive functioning skills like organization, theory of mind and attention to be successful and coherent (Brown, Garzarek & Donegan, 2014; Peterson, 2011).

Given that mindfulness practice and oral language skills, such as storytelling, might draw on similar cognitive processes, there has been growing interest in the potential facilitative effect of mindful yoga practice for supporting oral language and other educational goals (e.g., the Yoga Ed. Protocol, Steiner et al., 2012; Mind up, The Hawa Foundation, 2011). A recent study utilizing the Mind Up curriculum demonstrated an increase in overall language and vocabulary scores of kindergarten students (Thierry, Bryant, Nobles & Norris, 2016). The purpose of the present study was to investigate such facilitative effects empirically.

### **Methods**

#### Participants

A total of 4 kindergarten students (age 5;2 to 6;1) participated in this study. Families were recruited through the Developmental Psychology Applicant Pool or through previous participation in studies through the Language and Working Memory Lab at Western University. Baseline testing took place prior to the study to briefly assess language and non-verbal abilities. A non-standardized norm referenced task, *Tommy's Birthday*, provided information on baseline story retell ability and story comprehension, combined with an expressive language task, the *Recalling Sentences* subtest from the Clinical Evaluation of Language Fundamentals – Fourth Edition (Semel, Wiig & Secord, 2003) and a non-verbal task the *Matrix Reasoning* subtest from the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (Wechsler, 2002) as a measure of non-verbal intelligence. Parents completed a questionnaire on movement and literacy development as designed by the author. All children were within the average or above average range on the subtests utilized for expressive language ability and non-verbal intelligence.

#### Design and Procedures

This study utilized a pre-test single group design with no control group. The programming was designed by the author, a speech language pathology graduate student, who has a background in both health sciences and child development, and certification as a yoga instructor. All efforts were made to ensure postures were safe. No postures were used that involve having a child place pressure on his/her neck or head (e.g., shoulder stand, head stand, tripod).

The children attended the study weekly for a total of 6 weeks. During the first week, the children completed baseline assessment as well as the first session of yoga and stationary storytelling with retell. All story books were chosen based on similar plot structure (character/setting, initiating event, internal plan, attempt, outcome, solution) and a similar number of total words (300-400). The total number of events (main and supporting events) per book was calculated to match the total number of events per session (ranged from 83-92 events). The yoga condition and stationary condition were alternated in order each week. The children were not provided with specific prompts during their story retell (i.e., What happened in the story? Did anything else happen?).

Yoga Condition Participants listened to a story as read by the instructor. At five different points during the story, the instructor led the children through a variety of yoga poses that corresponded to a possible action in the book (e.g., trying to reach the stars by reaching both arms up to the sky and leaning towards each side). Following the story reading/yoga, the children lay down on their mats for 30 seconds of relaxation. During relaxation, children were instructed to close their eyes and lie on their mats. Story retells were then recorded for later analysis and transcription.

Stationary Condition Participants listened to a story being read by the instructor while seated in a circle. At five different points during the story, the instructor asked questions related to actions in the story (e.g., Are the cows typing quickly or slowly?). Following the story reading, the children stayed in the circle in silence for 30 seconds. Story retells were then recorded for later analysis and transcription.

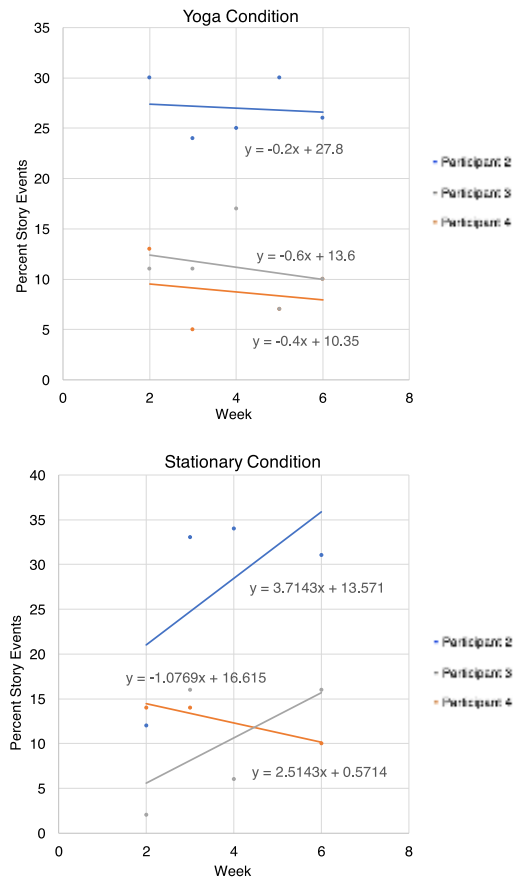
### **Results**

Two participants attended all 6 sessions. Participant three attended 4/6 sessions. Data from participant one was not included in the results due to incomplete attendance.

Results of this small-scale pilot study were analyzed by percent story events recalled at each session. The slope of percent events recalled was calculated across intervention weeks, as well as slope of percent story events recalled excluding the first week of the intervention (See Figure 1).

The two participants who attended all 6 weeks of the intervention showed an increase in percent events recalled across weeks in the stationary condition. The slope remained fairly consistent in the yoga condition for all three participants.

Figure 1  
Slope of Percent Story Events Recalled  
(Excluding Week 1)



### Conclusion

The present study was designed to assess the narrative retell ability of kindergarten children in both a yoga and stationary design. The findings from this brief, small sample study demonstrated that kindergarten children may benefit more from the stationary condition, when tasked with a story retell activity. It is possible that in the yoga condition, the children were required to utilize more of their cognitive load on participating in the yoga postures therefore they were less able to recall the story elements. In addition, kindergarten children may be more familiar with a stationary style of storytelling as this is often evident in a typical classroom. As Diamond (2012) discussed, perhaps younger children's executive functioning skills are better addressed through school curricula programming rather than direct intervention.

Study replication with a larger sample size and older children may yield different results, more consistent with Diamond (2012) and Diamond and Lee's (2011) predictions regarding mindfulness activities, movement and older children. In addition to this, executive

functioning tasks utilized in research are often more controlled and specific, unlike the task of story retelling. Therefore, although story retell may require executive functioning skills, the use of a story retell measure may yield different results due to task familiarity.

Amount of time in intervention is another consideration as the current study was 6 weeks in duration. Razza et al. (2013) and Flook et al. (2015) reported improvements in executive function results following mindfulness based programs in a yearlong and 12-week program, respectively. More rigorous research may be required to analyze the effect of mindfulness practice on story retell.

### Clinical Implications

As mindfulness and yoga become more prevalent in the education system, it will be important for clinicians to be aware of various practices and the effect of these practices on executive function. In particular, children with weak executive function skills may have more difficulty due to increase in cognitive load related to learning a new skill. Perhaps mindfulness activities should rather be used to prime children for learning rather than in combination with academic tasks.

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